POLYTECHNIC ASSOCIATION OF THE AMERICAN INSTITUTE.

The Association held its regular weekly meeting at its room at the Cooper Institute, on Thursday evening, April, 5, 1866, the President, Prof. S. D. Tillman, in the chair.

THERMOMETERS AS STEAM GAGES.

Dr. Rowell remarked that some time since he proposed the use of thermometers as steam gages, the relation of the temperature to the pressure of steam having been accurately determined ; the pressure could be ascertained with great precision by observing the temperature. Several engineers of his acquaintance had, accordingly, caused thermometers to be fixed in their boilers, but the bulbs very soon cracked to pieces, and the plan was therefore abandoned.

Dr. Parmelee said that the failure of the thermometers was due to the use of American glass in their manufacture. He had used thermometers a great deal, both in the laboratory and in vulcanizing rubber, and he had found that while tubes of American glass would crumble to pieces after use two or three times, bulbs blown from French or Bohemian glass would last seven months.

Professor Everett observed that our glass makers were doubtless able to prodnce good chemical glass, but they did not make the effort on account of the limited demand.

Dr. Feutchtwanger assented to this, and said that in the production of glass for achromatic lenses the American glass makers beat the world.

Dr. Rowell then proposed to reverse his plan; where difficulty is found in using thermometers for measuring temperatures, he would substitute a steam gage, and ascertain the temperature by measuring the pressure. He exhibited a small gage prepared for this purpose, intended especially for use in vulcanizing rubber, and remarked that the index moved over about an inch in ten degrees, while in the small thermometers in general use in vulcanizing, the movement of the mercury is through only one-tenth of an inch in ten degrees.

[It must be remembered that the measurement of the pressure by the temperature, or the measurement of temperature by pressure gage, is only to be trusted in the case of saturated steam. When the steam is superheated the temperature is higher with a given pressure than is given in Regnault's tables for saturated steam.—EDS. SCIENTIFIC AMERICAN.]

THE LOCALITIES OF PETROLEUM.

Professor C. H. Hitchcock, formerly of Amherst College, read a long paper on the geology of petroleum. He followed pretty nearly the same ground which has been repeatedly gone over at the Polytechnic by Dr. Stevens, whose remarks have been very fully reported in our columns A few of his statements, however, may be new to a portion of our readers. He agreed with Dr. Stevens in saying that pretroleum has been found in all the fossiliferous rocks, and that the principal oil-bearing formation in this country is the Devonian. He, however, seemed to regard some of the other formations more promising of a profitable yield than have generally been considered. Among them he mentioned the Triassic, in which petroleum has been found at Simsbury in Connecticut, and the silurian, which has been yielding oil in Cumberland county, Ky., since 1829. Between twenty and thiry years ago a great many wells were sunk in the Western States in search of salt water, and it was in this search that oil was struck in Cumberland county. As the mode of purifying the oil was not then known, it was allowed to run to waste. Since the great value of petroleum has become known, the sinking of wells in this district has been renewed, and some 25 or 30 of these wells are now yielding oil. Professor Hitchcock estimated that at least 75,000 barrels of petroleum has been raised in Cumberland county.

In regard to the disputed point of petroleum being found in California, the speaker said that at least 60,000 gallons have been sent to market in that State.

Tne formation of petroleum has been much discussed ; it is the result mainly of vegetable decomposition, though some of the Canadian and other deposits contain a small quantity of animal matter, as is shown by the presence of sulphur, and by their extremely offensive odors. Except in one case all the water he had found associated with petroleum was salt, and he would suggest that the submergence of vegetation beneath salt water may have been an essential condition of the formation of petroleum.

The yield of petroleum in the United States, for the last five years has been as follows,

1861	24,000,000 gallons.
1862	40,000,000 gallons.
1863	70,000,000 gallons.
1864	87,000,000 gallons.
1865	91,160,000 gallons.

At the present time the product is not less than 14,000 barrels per day.

THE USES OF PEAT.

The President announced peat as the regular subject for the evening. From the long discussion that followed we select for our columns only a portion of the remarks of Mr. Josiah B. Hyde. This gentleman has devoted several years to the examination of peat, and has written some very able papers upon it. He said there are two kinds of peat, the fibrous and the non-fibrous—the fibrous is fit for fuel only, but the non-fibrous has many valuable uses. It is as good for clarifying sugar as bone charcoal.

"Peat cannot be dried by natural means. In this vial is an ounce of it reduced to an impalpable powder. I pour a little into my hand, and blow a cloud of it across this room. I have spread this on porcelain plates and exposed it to the bright sun for hours, and on weighing it, found it to be still just an ounce ; but after two hours exposure to a temperature of 212°, it weighed three-fourths of an ounce. On again being exposed to the atmosphere it absorbed moisture and was restored to its original weight."

The subject of peat was continued for the next evening.

THE LENOIR GAS ENGINE.

BY FRED. J. SLADE.

Having had considerable opportunities for observing the practical working of this machine, the writer has thought some of the phenomena of its operation of sufficient interest to be made public. The principle of its action is as follows:—The piston moving at the beginning of its stroke by the momentum previously imparted to the fly-wheel, draws into the cylinder, through a suitable slide valve, a mixture of common illuminating gas and air. When the piston has moved through a little less than half the stroke the valve closes, and an electric spark is introduced into the cylinder and ignites the gases. The expansion caused by the heat of combustion drives the piston during the remainder of the stroke.

The composition of coal gas is not the same in all cases, but varies with the kind of coal used in its manufacture, and the extent to which the distillation is carried. A constitution probably not far from the average in our cities would be expressed by

Olefiant gas	7
Light corburetted hydrogen	56
Hydrogen	21
Carbonic oxide	11
Nitrogen	5
	190

Now, in combustion 1 cubic foot of olefiant gas unites with 3 cubic feet of oxygen and gives 2 cubic feet of carbonic acid and 2 of vapor water. One cubic foot of light carburetted hydrogen unites with 2 cubic feet of oxygen and gives 1 cubic foot of carbonic acid and 2 of vapor of water. One cubic foot of hydrogen unites with one-half a cubic foot of oxygen, and gives 1 cubic foot of vapor of water. One cubic foot of carbonic oxide unites with one-half a cubic foot of oxygen, and gives one cubic foot of carbonic acid.

The result of the combustion of 100 cubic feet of coal gas, therefore, will be represented as follows:—

		Oxygen		Vapor of Water.	Carbonic Acid.
Olefiant gas	7	and 21	yields	14	14
Light carburetted hydrogen	56	and 112	"	56	112
Hydrogen	21	and 10½	"		21
Carbonic oxide	11	and 5½	"	11	
Nitrogen	5		"	Nitrogen 5	
	100	149		86	147
Nit. associated with oxy. in air,		560		560	

Original gases.......... 809 yield products of combn, 793

We see from this that for the perfect combustion of gas of ordinary quality we must supply seven volumes of air for each volume of gas, and that for gases containing a greater proportion of hydro-carbons a greater quantity of air will be required, and, at the same time, the bulk of the products of combustion will be greater.

By applying a Richard's indicator of unusually delicate workmanship the writer obtained from an engine of $8\frac{2}{3}$ inches diameter of cylinder, and $16\frac{1}{4}$ inches stroke, diagrams of which the accompanying is a fair specimen.

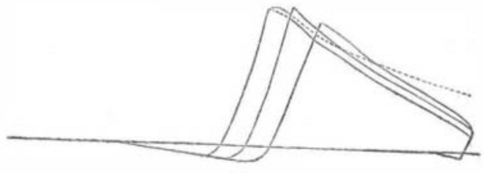

DIAGRAM A—50 REVOLUTIONS.

In this case as the explosion did not occur immediately on the closing of the valve, the tension of the gases falls to 11 lbs. per square inch (above a vacuum). After combustion it rises to 48 lbs. The temperature necessary to produce this pressure is found by the formula,

$$t_2=\frac{P_2(1+k\ (t_1-32°))-P_1}{P_1k}+32°,$$

in which t_1=temperature of the gases before combustion, taken at 200° on account of the warmth of the cylinder.

P_2 is 48 augmented in the proportion $\frac{809}{763}$ and the mean co-efficient of expansion k of the gases under constant volume is ·00204. This gives us as the temperature of the gases at the moment of combustion, 2474°. The dotted line represents the theoretical curve of expansion, taking into account the loss of heat and consequent fall of pressure due to the work done (which is the proper theoretical curve for an indicator diagram). The temperature at the end of the stroke indicated by this line would be 2156°. The actual final temperature shown by the diagram, supposing there to be no leakage, is 1438°. and the difference, 718°, is the quantity of heat absorbed by the water jacket with which the cylinder is surrounded. It will be observed from this card, that the explosion takes place so late in the stroke that there is a considerable available pressure in the cylinder at the end of the stroke, which, of course, is not utilized. To prevent this waste, the manufacturer of these engines in this country, Mr. Miers Coryell, sets the admission valve so as to close earlier; and this has the further advantage, that at the middle of the stroke a given quantity of work is performed in less time than at the ends, and consequently there is less loss of heat.

The diagrams give information which may be of interest to some as to the time required for the explosion of such a mixture of gases. In this case it appears to be about $\frac{1}{27}$ of a second.

Diagram B was obtained on one occasion when the electrical points in the cylinder were wet, and owing to the uncertain passage of the spark the explosions were very irregular. It is introduced here to show the difference between explosions occuring at the middle of the stroke and those nearer the ends. It will be observed that the pressure attained in the latter explosions rises somewhat higher than the true expansion curve drawn from the point attained by explosion near the middle of the stroke (which, as for this purpose, there is no work to be taken into consideration, would stand at the end of the stroke 4 2 lbs. higher than that shown).

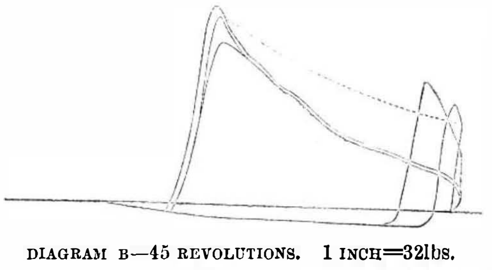

DIAGRAM B—45 REVOLUTIONS. 1 INCH=32lbs.

This is probably due to the greater heat acquired by the gases before explosion. It will also be noticed that the time of acquiring the maximum pressure is considerably greater in the later explosions, being $\frac{1}{30}$ of a second in the earlier and $\frac{1}{20}$ or more in the later.

Lastly, the great loss of pressure by cooling is strikingly shown—in equal times the lines fall below the hight due to expansion alone by an amount proportionate to the pressure that the gases would have at 32°. In the early explosions in this diagram, the pressure rises from 13 lbs. before explosion to 60 lbs. after, corresponding to a temperature of 3090°. The dotted line represents, as before, the true expansion curve, including the loss of 420° of heat and resulting diminutions of pressure due to the work done.

The construction of these engines is simple, differing in but few particulars from an ordinary horizontal steam engine. The cylinder and heads, as has been intimated, are cast hollow and kept cool by a current of water passing through them. The gas and air are admitted by a slide valve. The gas pipe is connected to a chamber bolted to the cylinder, and between which and the cylinder the slide valve moves. The gas passes through a small port in the back of the valve into the semicircular channel which covers it, and through this up and out of the valve into the atmosphere. It is then drawn down again by the suction of the piston through a number of small holes into the cup of the valve, and thence into the cylinder. This insures its thorough mixture with the air, while, at the same time, it prevents the possibility of explosion, since there is nowhere any explosive mixture except in the cylinder and cup of the valve, the latter being in open communication with the atmosphere.

An air chamber with openings, regulated by a slide, is placed over the holes in the valve to control the admission of air.

A separate valve on the other side of the cylinder is used for the exhaust. As constructed in the French engines this part is a weak point on account of the great heat to which it is subjected from the escaping gases. In the American engines, a small current of water passes through this valve and entirely removes this difficulty.

The spark for igniting the gas is supplied by a Bunsen's battery of one or two cells, and a Ruhmkorff coil giving from 100 to 150 sparks per second, and is distributed to each end of the cylinder.

To most persons it would probably appear that the great heat generated in the cylinder would be destructive of the surfaces. The writer, however, examined an engine that had been running regularly for a month, using in that time less than a quart of oil, and was surprised to find that the bore of the cylinder and the piston rod, though dirty from deposits of impurities, were not even scratched.

The explosion of the gas is unattended by any noise unless the connections are slack. The only size as yet constructed in this country is $4\frac{5}{8}$ inches diameter of cylinder by $8\frac{3}{4}$ inches stroke, though engines of larger dimensions are in process of construction. A friction dynamometer applied to one of these gave the following result:

Length of lever..................	4 feet
Weight applied..................	7 pounds.
Revolutions per mintue.........	185

16,280 foot-pounds per minute=$\frac{1}{2}$ horse-power.

In France there are engines of 3-horse power and upwards, but with the exorbitant prices of gas in this country, 1 or 2 horse-power is probably as high a power as could economically be obtained from this motor. These engines have the advantage that the expense ceases immediately with the work, which is an especial recommendation where the work is intermittent. They can be started and stopped instantly by merely turning the gas cock. They are absolutely free from danger and do not require the attention of an engineer; hence for small powers they are cheaper than steam. On account of their safety, they are admissable in situations where steam would not be.—*Franklin Journal.*

A Curious Experiment.—Into a bell glass full of air a central tube is made to carry a slow current of hydrogen. At the end of the tube, which is carried nearly to the dome of the bell glass, electric sparks are made to pass. The hydrogen is immediately ignited, taking the form of small luminous spheres, which rush about in all directions. After a few seconds there are an infinite number of these little luminous globes, which seem to play at hide-and-seek without ever coming into contact.—*Causeries Scientifiques, H. Parville,* 1866.

Correspondence

One View of Perpetual Motion.

Messrs. Editors:—There is a large class of your readers who are interested and benefited by the insertion of such problems as the "razor question," which you have happily disposed of on the correct basis. The writer came to the same conclusion after examining the expansive theory, and also the suggestion that it might be due to the heat of the razor softening the beard in the process of cutting it. Let any person make a lather from hot water, and take the precautions necessary to shave easy, and then experiment by alternately dipping the razor in hot water and cold, several times repeated, at the same shaving, making due allowance for the novel feeling of a cold instrument being applied at such a time, and the result will not be doubtful.

In a back number, you express a doubt as to what is the popular meaning of the term "perpetual motion." Allow one who had the "mania" when he was a boy, but was cured by experiment and reasoning before he was twenty years of age, to give his opinion.

Perpetual motion is a mechanical device, whose movements shall generate sufficient power to continue those movements, *ad infinitum,* allowing for repairs, which are incident to the wear of all machinery. A prominent idea is, that natural laws, gravitation especially, can be circumvented; but thus early I learned that gravitation could not be cheated; that if a pound was raised a foot high by slight effort, that effort must be continued longer, so that what was gained over weight was lost in time—a law of physical science of great and constant usefulness, when fully comprehended.

I have some respect for "perpetual motion" as an educator, especially to many who have not enjoyed the advantages of scientific training. The various phases of the "hobby" stimulate thought and work out a variety of problems, a knowledge of which cannot fail to be of use in after investigations. What is gained in this way is seldom lost, being the result of experience. I am no apologist for a waste of time and talent expended in foolish attempts to produce the "impossible," but to what extent the effort is to be considered a waste is the real question. The knowledge gained, skill in the use of tools, and schemes exploded, which were worthless, and are not to obtrude themselves again upon our attention, are, in individual cases, at least, ample recompense for their cost.

Those visionary theorists who never see the fallacy of one of their pet schemes, are hardly to be reached by reason or ridicule, and if diverted from their "one idea" for a season, are very apt to recur to it again.

Your pungent and happy hits at this class, are felicitously varied, amusing and very enjoyable.

Observer.

The Cascade of Light.

Messrs. Editors:—You rightly explain the phenomenon alluded to in your last issue by your correspondent "Argent." That portion of the illuminating ray which is tangent to the side of the falling stream, or meets it very obliquely, is reflected continuously around its whole circumference, and thus produces the appearance of a luminous point as broad as the jet and as high as the depth of the ray or pencil of light.

Well may you add that "one of the most brilliant experiments ever exhibited in a lecture room is the throwing of the electric light upon (or rather into) a column of falling water." In this case the jet issuing from the side of the containing vessel, its direction on leaving it is horizontal or tangent to the vertex of the parabolic curve which it describes. In the side of the vessel immediately opposite the point of issue of the jet, is a hole of corresponding size, filled in with a piece of glass or a glass lens, through which the rays from the adjoining focus or source of light are transmitted, concentrated on, and thrown into the flowing column of water, in a direction so nearly that of the initial portion of the jet itself, or so obliquely to its surface, as to be totally and continuously reflected from point to point throughout the whole stream, and down to the very basin in which the water is received, thereby giving it the appearance of a cauldron of liquid fire. The stream may be made to assume any hue, as the mere interposition of a piece of colored glass between the light and lens will necessarily give it the appearance of molten iron, gold or silver, or make it assume the aspect of a column of liquid ruby, emerald, or diamond, etc.

This most beautiful experiment was witnessed some five years ago, at the University here, under the able professorship of the Rev. Mr. Hamel, a young physicist of great promise, who explained the phenomenon in the most conclusive manner.

If the containing reservoir be made a hollow column, with water only in the periphery, the light in the center, a series of holes for as many jets on the outside, a corresponding inner series with appropriate lenses, and a rotating rim of variously colored glass, the numerous jets issuing together from the vessel in streams of liquid fire of beautiful and ever-varying hues, produce the most magical and enchanting effect that can well be imagined or described.

Chs. Baillange.

Quebec, C. E , April 5, 1866.

An Experiment with Clean Iron.

Messrs. Editors :—I have noticed in your journal several communications on the subject of cold or unmelted iron floating when placed in melted iron. And on searching for light on the subject, to-day we tried the experiment of placing a piece of cast iron that had been turned clean and smooth, in a ladle of melted iron, when it sunk immediately and did not rise again. Previous to placing the cast iron in the ladle we put a piece of lead in the ladle. The iron sunk as quickly as the lead and with much the same apparent effect on the melted iron. I have therefore come to the conclusion that the reason of unmelted iron floating is not because of the greater specific gravity of melted iron, but that the cause lies somewhere concealed in the coating of sand scale or rust that usually covers the pieces that are thrown in the melted iron as coolers or for experiment. With this clue perhaps you or some of your correspondents may enlighten us.

J. B. Boyce.

Lockport, N. Y., March 28, 1866.

Shaving with a Wooden Razor.

Messrs. Editors:—I read in one of your papers a number of years ago, a receipt for a wash or soap that would soften the beard so that it could be removed with a wooden razor. Now I have all the papers, but cannot seem to find it. Can you inform me what number or volume I can find it in?

A. M. S.

Boston, Mass., April 2, 1866.

[Milk of lime, sulphuret of arsenic, or other depilatory, will soften the beard or hair so that it may be brushed off. These things act on the skin, however, more powerfully than on the hair or beard. A person is not very likely to use them a second time.—Eds.

To Recover Gold from Solutions.

Messrs. Editors:—Please inform me in your Notes and Queries how to recover the gold from a plating solution which was spoiled by adding, direct, a nitro-muriate solution of gold to the common cyanide solution. I have Byrne's "Metal Worker's Assistant," but it does not relieve the quandary.

H. & J.

Paoli, Ind., April 2, 1866.

[The bath is probably not injured. To recover the gold, put a stick of bright zinc into the solution. Zinc will precipitate gold from any solution.—Eds.

Tyler's Safety Switch.

Messrs. Editors :—In your valuable paper of January 20th, I noticed a communication from the *Railway Times,* which highly recommends Tyler's safety switch, and as I desire to adopt it on this road, you would be conferring a great favor by giving me the address of the inventor or manufacturer.

J. S. Murray.

Cienfuegos, Cuba, March 1, 1866.

[We do not know the present address of Mr. Tyler—should this meet his eye, he will please to address Mr. Murray as above.—Eds.